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Thermal pyrolysis behaivor of crude oil by thermogravimetry-mass spectrum analysis (TG-MS) and differential scanning calorimeter (DSC)

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Abstract

© SGEM2018. Growth in the world economy requires an increase in global energy demand. And oil remained the world's leading fuel, accounting for a third of global energy consumption (BP's Energy Outlook, 2017 edition). However, the amount of conventional light oils is rapidly declining due to long-term and largely-scale extraction. Therefore, to relieve the pressure exerted on conventional oil resources, it is imperative to efficiently develop and utilize those unconventional oil reserves. Heavy oil is considered as an alternative energy. However, it is difficult to extract, transport and refine these heavy oils due to its high viscosity and high content of resins and asphaltenes. Therefore, it is imperative to achieve an in-situ oil upgrading to efficiently develop and utilize heavy oil resources. The study of the thermal pyrolysis of crude oil is essential to guide the upgrading of heavy oil. In this study, thermogravimetry-mass spectrum (TG-MS) and differential scanning calorimeter (DSC) were employed to investigate the pyrolysis behavior of crude oil in nitrogen atmosphere. The results showed that the entire pyrolysis of crude oil can be divided into three stages. The first stage is the evaporation of light fractions with low boiling point (<300 ℃), and the main gaseous products are hydrocarbons. The second stage is believed to be the evaporation of heavier fractions and the rupture of the weak chemical bound. The third stage is the main cracking and coke formation stage with the release of a large number of non-hydrocarbon gaseous products.

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Keywords

Crude oil, DSC, Oil upgrading, Pyrolysis, TG-MS

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